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Application of Synchrotron X-ray Computed Microtomography in Determining the Pore Structure in Cross-trough Laminated Sandstones

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Beamline(s): X27A

Introduction: Information on microstructures of geological materials, such as sandstones, plays a key role in geophysical and hydrologic studies, as they are important in understanding internal flow dynamics and rock formation mechanisms. Obtaining reliable microstructure information on these materials in a fast and easy way is always a challenge to geological scientists. Sequential sectioning is often used, but is slow and laborious. The application of synchrotron computed microtomography (CMT) is an effective alternative. It is a non-destructive technique that provides high-spatial resolution images of microstructures and requires little sample preparation.

Methods and Materials: In this study, three sandstone samples were investigated using CMT at the X27A beam line. These samples were collected from the Towaco Formation (Newark Supergroup) in New Jersey, USA. They are field-oriented samples, fine to medium grain sizes, micaceous sandstone with cross-trough lamination. The CMT equipment was operated with a voxel size of 0.0068 mm to produce tomographic volumes with a size of 1000 x 1000 x 200 voxels. Sample diameters of about 2 mm were used. This resolution allows us to quantify the spatial distribution, shape, orientation, and connectivity of pore and rock space for these sandstone samples.

Results: Fig. 1 shows synchrotron x-ray microtomography sandstone images. Dark blue areas indicate pore spaces. Other color areas indicate different minerals with different densities. Porosities of these samples are about 5%. Pore and/or laminated structures are revealed from these CMT images. First results indicate that these microscopic porosity characteristics correlate strongly with the type, scale, and orientation of macroscopic cross-lamination features. Ultimately, it may be possible to make better predictions of macroscopic fluid flow anisotropy based on the results found on the pore-size scale studied here.

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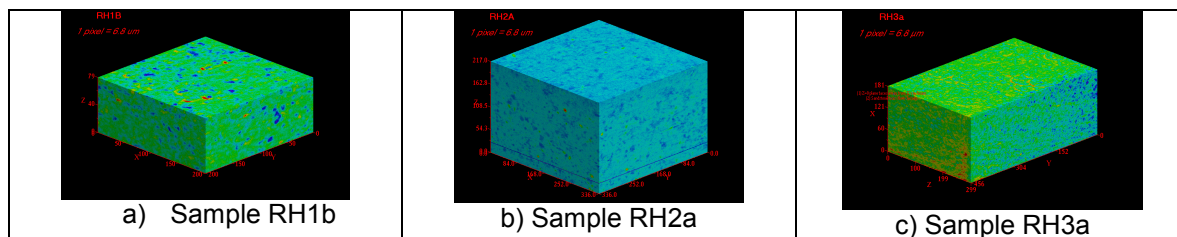


Figure 1. Sandstone samples from the Towaco Formation (Newark Supergroup), New Jersey, USA. (Sample dimension: 1.4 mm x 1.4 mm x 0.5 mm for RH1b; 2.3 mm x 2.3 mm x 1.5 mm for RH2a; and 2.0 mm x 3.0 mm x 1.2 mm for RH3a).